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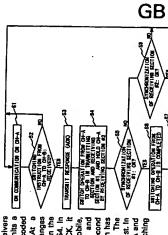
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(21) Application No 0227632.5	(22) Date of Filing 27.11.2002	(30) Priority Data (31) 2001861857 (32) 28.11.2001 (33) JP	(71) Applicants) NEC Corporation	[Incorporated in Japan] 7-1,Shiba 5-chome, Minato-ku, Tokyo, Japan	(72) Inventor(s) Tomostd Hotso	(74) Agent and/or Address for Service W P Thempson & Co 66 Dury Lene, LONDON, WCZB 650, United Kingdom

(54) Abstract The Channel switching method in a mobile communication system

predetermined time after ACK, the first needwer changes to the new channel-B, along with the transmitter in the mobile. The second receiver holds to channel-B S4. In the first receiver, if the base station receives ACK, it with the receives of the same time as the mobile. The switches to channel A at the same time as the mobile. The switches to channel A at the same time as the mobile. The source of the synchronises to the new channel-B S5. The second receiver is then also switched S7. If the base station has not received ACK, it will remain on channel A. The second receiver will S9 decode and the call is not lost. In this case, the mobile is switched back to channel A and communication continues until a further switching communication continues until a further switching communication. mobile terminal includes two receiving sections each capable of using different channel parameters to receive incoming signals, which contain pilot symbols and data symbols as well as instructions, initially both receivers are set to the channel-A. If a base station transmits a channel switching instruction, this is received, decoded \$2 and a response ACK is sent back \$3. At a mobile communication system, for example because of changes to service bearers, data rates, spread codes, the Instruction is received

Fig. 6



2 384 654

SHITCH FROM CH-A TO CH-B ON CORDANICATION ON CH-B Α

ig. 1A PRIOR ART

TPC 4BITS TFCI 88 TS DATA 12BITS 상

TRAFIC DATA COMMUNICATION RATE: 32 Kbps PHYSICAL BIT RATE (CONTAINING CONTROL SIGNAL):120 Kbps

PILOT 8BITS

DATA 48BITS

667msec

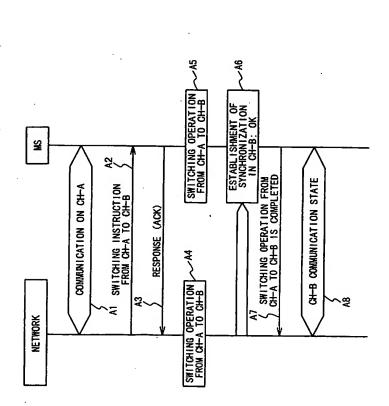
ART PRIOR മ Ø

P1L0T 8B1TS	
DATA 112BITS	
TPC 4BITS	
TFCI 8B1TS	
DATA 28B1TS	
8 -1 5	

TRAFIC DATA COMMUNICATION RATE: 64 Kbps PHYSICAL BIT RATE (CONTAINING CONTROL SIGNAL):240 Kbps

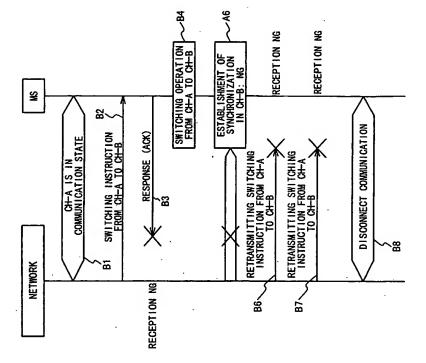
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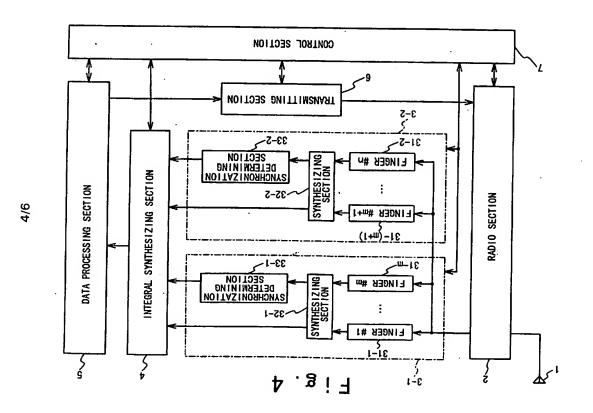
PRIOR Fig. 2



PRIOR Fig. 3

3/6





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ON COMMUNICATION ON CH-A

SSTITCHING SECTION

SSTITCHING SECTION

SSTITCHING SECTION

SSTITCHING OPERATION FROM

OF RECEIVING SECTION

SSTITCHING OPERATION

SSTITCHING SECTION

SSTITCHIN

CHANNEL SWITCHING METHOD AND MOBILE COMMUNICATION TERMINAL USING THE SAME

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The present invention relates to a channel switching method and related communication system and mobile communication terminal.

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In a mobile communication terminal of, for example, a CDMA (Code Division Multiple Access) type, there is a case that a physical data format is switched because of addition or removal of a service bearer, and change of

- 15 a data communication rate or a spreading code or the like during a communication. Hereinafter, the switching is referred to as a channel switching. In such a case, the channel switching needs to be carried out at the same time by a network side such as a radio
- 20 base station and a base station control station, and the mobile communication terminal.

Figs. 1A and 1B show physical reception data formats before and after a traffic data communication rate is switched from 32 kbps to 64 kbps in a mobile communication terminal of a W-CDMA (Wideband Code

Referring to Figs. 1A and 1B, it is supposed

Division Multiple Access) type, respectively.

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that a data format before a rate switching is CH-A (a traffic data rate: 32 kbps, and a physical bit rate format after the rate switching is CH-B (a traffic including a control signal: 120 kbps), and a data

- control signals, and Pilot is a control signal used to determine establishment of synchronization with a data rate: 64 kbps, and a physical bit rate including a control signal: 240 kbps). Here, data is a traffic Indicator) and TPC (Transmit Power Control) are layer data, and TFCI (Transport Format Combination 10
- Fig. 2 shows a conventional channel switching base station (a known bit pattern: a pilot signal).
- (CH-B) during communication using the data format (CHfrom a data format (CH-A) to a different data format sequence in the above-mentioned CDMA communication system. In Fig. 2, when a data format is switched

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- communication terminal (MS: Mobile Station) (Al of Fig 2), a switching instruction from the data format (CH-A) between the network side and the mobile
- A) to the data format (CH-B) is firstly outputted from a switching timing data the network side to the mobile communication terminal is simultaneously outputted such that the switching network side and the mobile communication terminal. operation is carried out at the same time in the of Fig. 2). At this time, 20
- The mobile communication terminal receives the switching instruction, and responds an with an

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mobile communication terminal waits for the switching from the data format (CH-A) to the data format (CH-B) timing, and then carries out the switching operation acknowledgement (ACK) (A3 of Fig. 2). Then, the

(A5 of Fig. 2).

that the mobile communication terminal carries out the switching operation from the data format (CH-A) to the On the other hand, the network side confirms data format (CH-B), from reception of the

- switching operation from the data format (CH-A) to the acknowledgment (ACK). Then, the network side walts for the switching timing, and carries out the , format (CH-B) (A4 of Fig. 10
- After the switching to the data format (CH-B), the completion of the switching from the data format reception signal, using the pilot signal of the data format (CH-B), and then notifies the network side of synchronization establishment determination of a the mobile communication terminal carries out a 15
- of Fig. 2) at a time when the synchronization establishment is OK (CH-A) to the data format (CH-B) (A7, A8 (normal) (A6 of Fig. 2). 20

switching method, there may be a case of a failure of <u>ښ</u> In the above-mentioned conventional channel instruction to the mobile communication terminal to the channel switching operation, as shown in At first, the network outputs the switching 25

carry out the switching operation from the data format (CH-A) to the data format (CH-B) (B1, B2 of Fig. 3). At this time, the switching timing data is simultaneously outputted such that the switching operation is carried out at the same time in the network side and the mobile communication terminal.

The mobile communication terminal receives the switching instruction, and returns the acknowledgment (ACK) (B3 of Fig. 6). Then, the mobile communication terminal waits for the switching timing, and carries out the switching operation from the data format (CH-A) to the data format (CH-B) (B4 of Fig. 3).

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Here, if the network side cannot receive the acknowledgment (ACK) from the mobile communication terminal for any reason, it is impossible to confirm that the mobile communication terminal carries out the switching operation from the data format (CH-A) to the data format (CH-A) to the format (CH-A) to the data format (CH-B) even at the time of the arrival of the switching timing. In the mobile communication, there is a possibility that failure of signal reception frequently occurs because of fading, interference and the like in a radio

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On the other hand, the mobile communication terminal carries out the switching operation to the

interval

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data format (CH-B), and then carries out the synchronization establishment determination of the reception signal using a pilot signal of the data format (CH-B). However, since the network side holds the data format (CH-A), the synchronization establishment is NG (abnormal) (B5 of Fig. 3).

After that, the network side uses a timer to output the switching instruction to the data format (CH-B) to the mobile communication terminal again (B6,

- 10 B7 of Fig. 3). However, since having already switched to the data format (CH-B), the mobile communication terminal cannot receive the switching instruction.

 After all, the communication is disconnected (B8 of Fig. 3).
- spectrum spreading communications system is disclosed in Japanese Laid Open Patent Application (JP-A-Helsei 11-4211). In this conventional example, a carrier frequency is switched from a first frequency to a
 - base station. After hand-over is carried out from the first base station to a second base station, a carrier frequency in communication with the second base station to a station station is switched from the second frequency to a
 - 25 third frequency. The second frequency is a frequency in the hand-over exclusive use.

Also, a CDMA mobile phone is disclosed in

Japanese Laid Open Patent Application (JP-A-Heisei 11-69449). In the CDMA mobile phone of this conventional example, a transmission and reception section sends and receives a radio signal with a base station.

- demodulation modulates a baseband signal to the radio reception paths at a same time. A modulation and baseband signal. A coding and decoding section signal and demodulates the radio signal in the rake reception section receives a plurality of S
- section converts a speech signal into the communication into the communication signal and the control encodes a communication signal and a control signal into the baseband signal and decodes the baseband A transmission unit and a sound coding signal
- A reception unit and a sound decoding section convert the communication signal into a speech signal. A control section controls an operation based on the station as the control signal. The transmission and control signal and sends necessary data to the base signal. 13
- base station or a plurality of different base stations reception section receives signals sent out from the in two or more frequencies at a time, and transmits signal to it or them. 20

channel estimating apparatus is composed of a first (JP-P2000-4212). In this conventional example, the disclosed in Japanese Laid Open Patent Application Also, a channel estimating apparatus is 25

multiple-transmitted from a single antenna. The state of the channel is estimated from both of the received receiving section which receives a pilot signal on first channel and a second receiving section which receives pilot signals on a second channel which signals. Also, a synchronizing circuit is disclosed in Japanese Laid Open Patent Application (JP-P2000-244387). In the synchronizing circuit of this

- is carried out to obtain correlation output for every station on communication. A correlation calculation and the correlation outputs are combined. plurality of branches is carried out with a base conventional example, diversity reception at a branch, 10
- signal from a base station as a switching destination is temporally stored, and the correlation calculation period which the correlation calculation using any of of the stored signal is carried out during a time the branches is not carried out, to establish 15
- synchronization with the switching destination. 20

Also, a base station is disclosed in Japanese In this conventional example, a communication region covered by the base station is variable. The change of a Laid Open Patent Application (JP-P2001-8262).

spreading code is notified from a transmitting side to a receiving side between the base station and a mobile terminal using a channel, and after the notification, 25

the spreading code is changed such that interference between the channel and another channel is reduced.

The present invention seeks to provide for a communication terminal system and channel switching method having advantages over known such terminals, systems and methods.

a second pilot symbol signal and a second data symbol signal from the reception data signal using the first transmission data signal and transmits a radio signal symbol signal. The second receiving section produces second receiving section, a transmitting section, an signal from the network side via an antenna to and a control section. The radio section receives a integral synthesizing section, a processing section synchronization establishment from the first pilot radio signal, produce a transmission signal from a mobile communication terminal communicating with a The first receiving produce a reception data signal from the received network side, includes a radio section, first and In an aspect of the present invention, a corresponding to the transmission signal to the current channel parameter data, and determines section produces a first pilot symbol signal first data symbol signal from the reception signal using a first channel parameter data network side via the antenna.

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The transmitting processing section processes the reception data symbol transmission data signal to the radio section using the first channel parameter data second data symbol signal selectively combines the first establishment parameter data. The integral to produce a reception data symbol signal. The signal, outputs the transmission data to the signal. data, and determines synchronization symbol data symbol signal and the from the second pilot section transmits the as a current channel synthesizing section 10

transmitting section, and outputs a channel switching signal from the first channel parameter data to a second channel parameter data when the reception data symbol signal contains the channel switching signal.

The control section outputs an acknowledge as the transmission data to the processing section in response to the channel switching instruction such that the acknowledge is transmitted from the transmitting section, sets the second channel

parameter data to the first receiving section and the transmitting section, and receives the determining result of the synchronization establishment in each of the first and second receiving sections.

The present invention can advantageously provide a channel switching method by which a success rate of a channel switching sequence can be improved, and a CDMA communication system of a mobile

channel parameter data as a current channel parameter

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communication terminal and a base station, using the

of a mobile communication terminal and a base switching can be reduced, and a CDMA communication probability in a user data at a time of a channel provide a channel switching method by an error Further, the present invention can station, using the same.

established after the first channel parameter data is section sets the second channel parameter data to the receiving section that the synchronization has been case, the control second channel parameter to the second receiving response to the completion of the setting of the Here, when it is determined in the first set to the first receiving section, the control transmission data to the processing section in section such that the switching completion is section outputs a switching completion as the transmitted from the transmitting section. In this second receiving section. 20

established, after the first channel parameter data is first receiving section and the transmitting section. section sets the first channel parameter data to the receiving section that the synchronization has been In this case, when the control section receives the receiving section that the synchronization has been not established, and it is determined in the second Also, when it is determined in the first set to the first receiving section, the control 25 20

- 11

result of the synchronization establishment in each of parameter data to the first receiving section and the response to said channel switching instruction such transmitting section, and receives the determining channel switching instruction again, the control that said acknowledge is transmitted from said transmitting section, sets the second channel transmission data to said processing section section which outputs said acknowledge as the first and second receiving sections.

a symbol rate reception data signal from the reception a plurality of finger sections, each of which produces Also, the first receiving section may include data signal at a chip rate using the current channel

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- synthesizes the symbol rate reception data signals to data symbol signal and outputs the first data symbol produce the first pilot symbol signal and the first signal to the integral synthesizing section, and parameter data; a synthesizing section which 15
- outputs the first pilot symbol; and a synchronization symbol signal and outputs the determining result to synchronization establishment from the first pilot the integral synthesizing section and the determining section which determines the 20
- include a plurality of finger sections, each of which produces a symbol rate reception data signal from the section. Also, the second receiving section may 25

reception data signal at a chip rate using the current produce the second pilot symbol signal and the second synthesizes the symbol rate reception data signals to channel parameter data; a synthesizing section which

- outputs the second pilot symbol; and a synchronization data symbol signal and outputs the second data symbol to the integral synthesizing section, and signal S
 - synchronization establishment from the second pilot signal and outputs the determining result to the integral synthesizing section and the control determining section which determines the section symbol 10

CDMA communication system, includes a base station and In another aspect of the present invention,

- receiving section, a transmitting section, an integral communication terminal communicating with a network side, includes a radio section, first and second mobile may include a mobile a mobile communication terminal. The communication terminal 15
 - a reception data signal from the received radio signal, signal from the network side via an antenna to produce produce a transmission signal from a transmission data signal and transmits a radio signal corresponding to control section. The radio section receives a radio and a synthesizing section, a processing section 20 25

antenna. The first receiving section produces a first

the transmission signal to the network side via the

- 13

and determines synchronization establishment from the from the reception data signal using a first channel data, pilot symbol signal and a first data symbol signal section produces a second pilot symbol signal and second data symbol signal from the reception data signal using the first channel parameter data as second receiving current channel parameter data, and determines parameter data as a current channel parameter The first pilot symbol signal.

- symbol signal. The transmitting section transmits the the first channel parameter data as a current channel synchronization establishment from the second pilot transmission data signal to the radio section using parameter data. The integral synthesizing section 10
- selectively combines the first data symbol signal and data symbol signal: The processing section processes the second data symbol signal to produce a reception transmission data to said transmitting section, and the reception data symbol signal, outputs said 15
 - channel parameter data to a second channel parameter data when the reception data symbol signal contains outputs a channel switching signal from the first outputs an acknowledge as said transmission the channel switching signal. The control 20
- transmitted from said transmitting section, sets the that said acknowledge is said processing section in response to said switching instruction such 25

section and the transmitting section, and receives the second channel parameter data to the first receiving establishment in each of the first and second determining result of the synchronization

receiving sections.

established after the first channel parameter data is receiving section that the synchronization has been Here, when it is determined in the first the first receiving section, the control to

section sets the second channel parameter data to the receiving section. In this case, the control response to the completion of the setting of said second channel parameter to said second receiving transmission data to said processing section in outputs a switching completion as said section such that said switching completion is transmitted from said transmitting section. second 12 10

established, after the first channel parameter data is first receiving section and the transmitting section. the In this case, when the control section receives the not established, and it is determined in the second receiving section that the synchronization has been receiving section that the synchronization has been section sets the first channel parameter data to Also, when it is determined in the first channel switching instruction again, the control set to the first receiving section, the control

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section, sets the second channel parameter data to the section outputs said acknowledge as said transmission said acknowledge is transmitted from said transmitting ţ٥ data to said processing section in response that channel switching instruction such

- synchronization establishment in each of the first and first receiving section and the transmitting section, and receives the determining result of the second receiving sections.
- a symbol rate reception data signal from the reception a plurality of finger sections, each of which produces Also, the first receiving section may include data signal at a chip rate using the current channel parameter data; a synthesizing section which
- synthesizes the symbol rate reception data signals to outputs the first pilot symbol; and a synchronization data symbol signal and outputs the first data symbol produce the first pilot symbol signal and the first signal to the integral synthesizing section, and 15
- symbol signal and outputs the determining result to synchronization establishment from the first pilot the integral synthesizing section and the control section. Also, the second receiving section may determining section which determines the 20
- reception data signal at a chip rate using the current include a plurality of finger sections, each of which produces a symbol rate reception data signal from the 25

synthesizes the symbol rate reception data signals to produce the second pilot symbol signal and the second data symbol signal and outputs the second data symbol channel parameter data; a synthesizing section which

- outputs the second pilot symbol; and a synchronization synchronization establishment from the second pilot symbol signal and outputs the determining result to signal to the integral synthesizing section, and determining section which determines the
 - the integral synthesizing section and the control 10

mobile communication terminal when the acknowledge is transmits the channel switching instruction to the Also, the base station may set the second parameter data when the acknowledge is received. Alternatively, the base station rechannel

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channel parameter data when the switching completion Also, the base station may communicate with the mobile communication terminal using the second signal is received.

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mobile communication terminal, replying an acknowledge response to reception In another aspect of the present invention, of a channel switching instruction using a first channel switching method is achieved by (a) in channel parameter data, the channel switching from a transmitting section in

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instruction instructing a channel switching operation from the first channel

- 17

to a second parameter data; by (b) in the mobile parameter data

communication terminal, carrying out the channel

receiving section and the transmitting section; and by switching operation from the first channel parameter data to the second channel parameter data in a first

in the mobile communication terminal, holding the first channel parameter data in a second receiving <u>0</u>

section. 10

may further include: (d) in the mobile communication terminal, checking synchronization establishment in In this case, the channel switching method the first receiving section and a second receiving section after the channel switching operation.

Also, the channel switching method may

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further include:

carrying out the channel switching operation from the parameter data in the second receiving section, when first channel parameter data to the second channel (e) in the mobile communication terminal,

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it is determined by the first receiving section that synchronization is established. In this case, channel switching method may further include:

(f) transmitting a switching completion signal from the mobile communication terminal.

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In this case, the channel switching method

may further includes:

- carrying out the channel switching operation from the second channel parameter data to the first channel (g) in the mobile communication terminal,
- receiving section that synchronization is established. parameter data in the first receiving section and the first receiving section that synchronization is not transmitting section, when it is determined by the established and it is determined by the second
 - Also, the channel switching method may further include:
- parameter data to the second channel parameter data channel switching operation from the first channel (h) in a base station, carrying out the when the acknowledge is received.

Also, the channel switching method may further include:

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communication terminal, when the acknowledge is not (i) in a base station, re-transmitting the channel switching instruction to the mobile received

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Also, the channel switching method may further include: (j) communicating between a base station and

the mobile communication terminal using the second channel parameter data. 25

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hereinafter by way of example only with reference to The invention is described further accompanying drawings in which:

formats before and after a rate switching operation in Figs. 1A and 1B are diagrams showing data a conventional example, respectively;

Fig. 2 is a sequence chart showing a channel switching operation in the conventional example;

operation when the channel switching operation is 3 is a sequence chart showing an failed in the conventional example; Fig.

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structure of a mobile communication terminal according Fig. 4 is a block diagram showing the to an embodiment of the present invention;

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switching operation according to an embodiment of the Fig. 5 is a sequence chart showing a channel present invention; and

a time of the channel switching operation according to Fig. 6 is a flowchart showing an operation at embodiment of the present invention.

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Hereinafter, a CDMA communication system of a mobile communication terminal and a network side such according to the present invention will be described as a base station and a base station control unit with reference to the attached drawings. 25

Fig. 4 is a block diagram showing the

4, the mobile communication terminal according to the embodiment of the present invention is composed structure of a mobile communication terminal according Referring an integral synthesizing section 4, a data processing 5, a transmitting section 6 and a control section (#1) 3-1, a receiving section (#2) 3-2, antenna 1, a radio section 2, a receiving embodiment of the present invention. section section an of an 40 t 0

conversion to the radio signal to produce a reception radio section 2 carries out various operation such as data signal at a chip rate. Then, the radio section transfers the reception data signal to the receiving section (#1) 3-1 and the receiving section (#2) 3-2(not shown) through the antenna 1, the receiving a radio signal from a radio demodulation of data, an A/D (Analog/Digital) a down conversion in frequency, an orthogonal When base station 15 10

The receiving section (#1) 3-1 is composed of radio base station chip an up conversion of operation such as a D/A (Digital/Analog) conversion, a frequency to a transmission data signal of the rate from the transmitting section 6, and then Also, the radio section 2 carries out various transmits as a radio signal to the of data, an orthogonal modulation 20

one or more finger sections (#1 to #m) (10m) 31-1

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31-m, a synthesizing section 32-1 and

- 21

synchronization determining section 33-1.

to the reception data signal at the chip rate supplied The control section 7 sets channel parameter of a despreading operation and a phase compensation from the radio section 2 using the channel parameter rate data, and generates a reception data signal at a a symbol to 31-m. 31-1 to 31-m data such as a despreading code and to #m) 31-1 to #m) finger sections (#1 finger sections (#1 the S

symbol rate. Then, each finger section transfers the reception data signal at the symbol rate to the synthesizing section 32-1. 10

data signal such as a symbol rate, the number of pilot parameter data about the data format of the reception symbols, the number of data symbols, and data of the finger sections to be combined to the synthesizing section 32-1. However, in the case of m=1, the The control section 7 sets the channel synthesizing section 32-1 is not needed. The

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- pilot symbol signal and a data symbol signal using the finger sections (#1 to #m) 31-1 to 31-m to produce a synthesizing section 32-1 synthesizes the reception data signals at the symbol rates supplied from the channel parameter data. Then, the synthesizing 20
- signal to the synchronization determining section 33-1, section 32-1 transfers the pilot symbol (known symbol) and transfers the data symbol signal to the integral 25

synthesizing section

The synchronization determining section 33-1 determining operation by comparing the pilot symbol carries out the synchronization establishment

- comparing result to the integral synthesizing section 4 and the control section 7. For example, if there signal supplied from the synthesizing section 32-1are erroneous pilot symbols of Npl or more for Tpl with a known symbol pattern, and notifies the ഹ
 - [sec], the synchronization determining section 33-1 Also, the synchronization determining section 33-1 The control section 7 sets the channel determines that synchronization is NG (abnormal). parameter data to the synchronization determining determines that synchronization is OK (normal), section 33-1. 15

(#1 to #m) 31-1 to 31-m without using the pilot symbol Also, the synchronization determining section 33-1 may carry out the synchronization establishment signals supplied from the respective finger sections signal supplied from the synthesizing section 32-1. determining operation by using the pilot symbol

The receiving section (#2) 3-2 is composed of m+1<n) 31-(m+1) to 31-n, a synthesizing section 32-2 and more finger sections (#m+1 to #n) ($1\square m$, synchronization determining section 33-2

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the control section 7 sets channel parameter

- 23

compensating operation to the reception data signal at the chip rate supplied from the radio section 2 using the channel parameter data, and generates a reception data such as a despreading code and a symbol rate to 31-(m+1) to carries out a despreading operation and a phase the 31-n. data signal at a symbol rate. Then, each finger section transfers the reception data signal at the finger sections (#m+1 to #n) 31-(m+1) to of the finger sections (#m+1 to #n) Each

data signal such as a symbol rate, the number of pilot parameter data about the data format of the reception symbols, the number of data symbols, and data of the The control section 7 sets the channel

symbol rate to the synthesizing section 32-1.

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- synthesizing section 32-2 synthesizes the reception finger sections to be combined to the synthesizing data of the symbol rates supplied from the finger section 32-1. However, in the case of m=1, the synthesizing section 32-1 is not needed. The 15
- pilot symbol signal and a data symbol signal using the signal to the synchronization determining section 33-2, section 32-1 transfers the pilot symbol (known symbol) sections (#m+1 to #n) 31-(m+1) to 31-n to produce a channel parameter data. Then, the synthesizing 20

synthesizing section 4.

The synchronization determining section 33-2

and transfers the data symbol signal to the integral.

determining operation by comparing the pilot symbol signal supplied from the synthesizing section with a known symbol pattern, and notifies the carries out the synchronization establishment

- are the erroneous pilot symbols of Npl or more for Tpl comparing result to the integral synthesizing section [sec], the synchronization determining section 33-2 4 and the control section 7. For example, if there Also, the synchronization determining section 33-1 determines to be the synchronization NG (abnormal) (normal), determines that synchronization is OK 10
- the synchronization determining section 33-1 may carry out the synchronization establishment determining operation by using the pilot symbol Also, section 33-2.

otherwise. The control section 7 sets the channel

parameter data to the synchronization determining

to #n) 31-(m+1) to 31-n without using the pilot symbol signal from the synthesizing section 32-2. (##+1 20

signals supplied from the respective finger sections

synthesizes the reception data symbol signals from the of the receiving section (#1) 3-1 and the synthesizing section 32-2 of the The integral synthesizing section 4 synthesizing section 32-1

recelving section (#2) 3-2 to produce a synthesized the data processing section 5. However, the synthesizing data symbol signal, and transfers it to 25

section 4 does not synthesize the reception data

symbol signals from the receiving section (#1) 3-1 and synchronization establishment determining operation the receiving section (#2) 3-2 if the result of the

from the synchronization determining section 33-1 synchronization determining section 33-2

Also, there is a case that the synthesizing section 4 the selected signal to the data processing section 5. instruction from the control section 7 and transfers (#1) 3-1 and the receiving section (#2) 3-2 without symbol signal from any one of the receiving section synthesizing section 4 selects the reception data the synthesizing operation in accordance with an Also, there may be a case that the 10

does not transfer any of them to the data processing section 5 in accordance with an instruction from the control section 7. 12

Interference power Ratio), and a function to control a Also, the integral synthesizing section 4 has Control) and the like. However, they have no direct a function to measure a reception SIR (Signal to their transmission power through TPC (Transmit Power relation to the present invention. descriptions are omitted.

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The data processing section 5 processes the synthesizing section 4, and sends received control reception data symbol signal from the integral 25

processing section 5 receives control data (layer 3 to the to the control message and the like) supplied from the control transmitting section 6. In this case, the data section 7, and then sends transmission data data (layer 3 message and the like)

transmitting and receiving user data (traffic data). section 7, and carries out the process for

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spreading processes to a physical channel and the like, and then transfers the results to the radio section 2 the current channel parameter data which is set data from the data processing section 5, mapping and correction coding process to the transmission The transmitting section 6 carries out an by the control section 7. 10

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the synchronization establishment determination to the receiving section (#1) 3-1, the receiving section (#2) number of user data symbols and the like, data of the section 7 sets the channel parameter data containing any of the despreading code, the symbol code of the finger sections to be combined, and a parameter for mentioned respective blocks. That is, the control The control section 7 controls the abovethe number of pilot symbols, the 3-2 and the radio section 6 in response to reception data, 20

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establishment determination from each of the receiving section (#1) 3-1 and the receiving section (#2)

symbol signals should be selected or neither of them the reception data symbol signals from the receiving should be synthesized, any one of the reception data should be not selected, to the integral synthesizing control section 7 can set whether section (#1) 3-1 and the receiving section (#2) the section 4.

data processing section 5 to transmit and receive the control data (layer 3 message and the like), and sets Moreover, the control section 7 controls the spreading code, the symbol rate of the transmission the channel parameter data containing any of the data user, and an encoding parameter to the transmitting section 6.

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switching operation according to the embodiment of the embodiment of the present invention. The channel Fig. 5 is a sequence chart showing the present invention will be described below with channel switching operation according to the

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terminal communicate with each other using the data At first, the network side such as a base station (not shown) and the mobile communication

reference to Figs. 4 and 5.

issues the channel switching instruction from the data

the network side

In this situation,

format (CH-A).

Also, the control section

receives the result of the synchronization

operation is carried out.

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switching instruction. Thus, the channel switching

At this to the mobile time, the switching timing data is simultaneously outputted such that the switching operations are of Fig. 5). format (CH-A) to the data format (CH-B) communication terminal (C1 to C3

carried out at the same time in the network side and switching instruction and the switching timing data receiving sections 3-1 and 3-2, and the integral the mobile communication terminal. The channel are received through the radio section 2, the

synthesizing section, and supplied from the data processing section 5 to the control section 7. 10

control section 7 controls the data processing section 5 to return the acknowledgment (ACK) in response to In the mobile communication terminal, the

- (not shown). Thereafter, on the switching timing, the timing based on the switching timing data and a timer parameter data to Then, the control section 7 waits for the switching the channel switching instruction (C4 of Fig. 5) control section 7 sets the channel 15
- transmitting section 6 and the receiving section 3-1. 3-1. Thus, the mobile communication terminal carries receiving section out the channel switching operation from the data However, the control section 7 does not set the in the format (CH-A) to the data format (CH-B) the transmitting section 6 and the 20 25

channel parameter data to the receiving section 3-2 at

present time (C5, C6, C7 of Fig. 5). Therefore,

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the receiving section (#2) 3-2 is still held at the format (CH-A). Here, if the network side cannot receive the acknowledgment (ACK) because of any reason, for

- the radio region, it is impossible to confirm that the switching operation from the data format (CH-A) to the mobile communication terminal carries out the channel example, the fading, the interference or the like in data format (CH-B). Thus, the network side does not
- data format (CH-A) to the data format (CH-B) even at carry out the channel switching operation from the time of the arrival of the switching timing. the 10

data format (CH-B), the receiving section (#1) 3-1 of After the channel switching operation to the

- determination of the synchronization establishment of data format (CH-B). Also, the receiving section (#2) a reception data signal uses the pilot signal of the 3-2 of the mobile communication terminal carries out the mobile communication terminal carries out the 15
- the determination of the synchronization establishment of the reception data signal uses the pilot signal of synchropization establishment determination result in Thus, the the data format (CH-A). In this case, the network side is still at the data format (CH-A). 20
 - determination result in the receiving section 3-2 is ် the other hand, the synchronization establishment 5) (C8 of g the receiving section 3-1 is 25

establishment determination result of the receiving establishment determination result of the receiving section (#2) 3-2 is OK (C9 of Fig. 5), the channel communication section (#1) 3-1 is NG, and the synchronization OK (C9 of Fig. 5). When the synchronization switching operation in the mobile

this case, the control section 7 sets the parameter data for the data format $(CH-\bar{A})$ to terminal is not carried out. channel

receiving section (#1) 3-1 of the mobile communication the receiving section 3-1 and the transmitting section Thus, the channel switching operation is carried (CH-A) again in the transmitting section 6 and the out from the data format (CH-B) to the data format 10

synchronization establishment determination result is control section 7 controls the integral synthesizing In this case, the receiving section $(\sharp 1)$ 3-1 is discarded when the section 4 such that the reception data by the terminal (C10, C11 of Fig. 5). 15

section (#2) 3-2 is processed when the synchronization communication in a state in which the reception error the receiving Consequently, it is possible to continue the j.s NG, and only the reception data by establishment determination result 20

format (CH-B), the receiving section (#1) 3-1 of data

(not shown) to issue the channel switching instruction

After that, the network side uses a timer

is free, using the data format (CH-A)

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communication terminal, the to the data format (CH-B) from the data format (CH-A) control section 7 receives the channel switching to the mobile communication terminal again (C12, In the mobile 5).

section 5 such that the acknowledge is returned to the network side. Then, the control section 7 waits for instruction again, and controls the data processing the switching timing after returning the

acknowledgment (ACK), and sets the channel parameter

- section 3-1. Thus, the channel switching operation is format (CH-B), described above. However, the control data to the transmitting section 6 and the receiving section 7 does not set the channel parameter data to carried out from the data format (CH-A) to the data 10
 - the receiving section 3-2 at the present time (C16, C18 of Fig. 5). 15

receives the acknowledgment (ACK), the network side On the other hand, since the network side confirms that the mobile communication terminal

carries out the channel switching operation from the carries out the switching operation from the data the network side waits for the switching timing, of data format (CH-A) to the data format (CH-B). (C15 the data format (CH-B) (CH-A) to format 20

After the channel switching operation to the

synchronization establishment of the reception signal At this time, the format of the network side is also using the pilot signal of the data format (CH-B). the mobile communication terminal checks the

synchronization establishment determination result is S) in the receiving section (#1) 3-1 (C19 of Fig. switched to the data format (CH-B). Thus, the

synchronization establishment determination result of When the control section 7 receives that the

the completion of the channel switching operation section 7 controls the data processing section 5 such the data format (CH-A) to the data format (CH-B) is notified to the network side (C20 of Fig. 5). At the receiving section (#1) 3-1 is OK, the control from 10

parameter data to the receiving section (#2) 3-2 still the same time, the control section 7 sets the channel Thus, the channel switching operation is carried out from the data format (CH-A) to the data format (CH-B) in the held at the data format (CH-A). 15

the Thereafter, the communication is carried out using receiving section (#2) 3-2 (C21 of Fig. 5) data format (CH-B). 20

In this case, the reception data by

receiving section (#2) 3-2 is discarded because it is processed when the synchronization establishment still held at the data format (CH-A). Therefore, the reception data by the receiving section (#1) 25

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determination result is OK. Thus, it is possible to continue the communication in which the reception (CH-B) error is free, using the data format

order to attain the above-mentioned

- terminal needs to include the two receiving sections switching method, the mobile communication (the receiving section (#1) 3-1 and the receiving terminal generally includes a plurality of finger section (#2) 3-2). The CDMA mobile communication channel
- transfer reception and the soft handover. Thus, the receiving sections using the pilot signals. Each of the finger receiving sections carries out the usual receiving sections in order to carry out the multipresent invention can be attained using two finger 10
- operations (the multi-transfer reception, the soft the handover and the like) at the time other than channel switching operation. 15

Fig. 6 is a flowchart showing the operation at the time of the channel switching operation

- according to the embodiment of the present invention. operation according to the embodiment of the present The operation at the time of the channel switching invention will be described below with reference Figs. 4 and 6. 20
- When the mobile communication terminal format (CH-A) (Step S1 of Fig. 6), if the using communicating with the network side 25

communication terminal receives the channel switching format (CH-B) from the network side (Step S2 of Fig. instruction (layer 3 message) to a different data

- 6), the mobile communication terminal transmits to the network side the acknowledgment (ACK) corresponding to the channel switching instruction from the data format After that, in the mobile communication terminal, the 9 transmitting section 6 and the receiving section (#1) (CH-A) to the data format (CH-B) (Step S3 of Fig.
- carry out the channel switching operation from the data format (CH-A) to the data format (CH-B), and the (CHreceiving section (#2) 3-2 holds the data format A) (Step S4 of Fig. 6). 3-1 10

After that, if the synchronization

- mobile communication terminal transmits to the network 6). In succession, the side a channel switching completion notice (the layer communicates with the network side at the data format mobile communication terminal switches the receiving to the receiving section (#1) 3~1 (Step S5 of Fig. 6), the 3 message) from the data format (CH-A) to the data establishment determination result is OK in the section (#2) 3-2 from the data format (CH-A) data format (CH-B) (Step S7 of Fig. 6), and format (CH-B) (Step S6 of Fig. 15 20
- On the other hand, when the synchronization establishment determination result is NG in the

(CH-B) (Step S8 of Fig. 6).

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synchronization establishment determination result is transmitting section 6 and the receiving section (#1) 6), the mobile communication terminal switches the 3-1 from the data format (CH-B) to the data format receiving section (#1) 3-1 (Step S5 of Fig. 6), 89 (Step 3-2 OK in the receiving section (#2)

Then, the operation flow returns back to the step S1, and the mobile communication terminal waits for re-issuance of the switching instruction to the

data format (CH-B)

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S9 of Fig. 6), the operation flow returns back to the result is NG in the receiving section (#2) 3-2 (Step step S1, and the mobile communication terminal waits Also, in the mobile communication terminal, for re-issuance of the switching instruction to the if the synchronization establishment determination data format (CH-B)

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As mentioned above, in this embodiment, the mobile communication terminal of the CDMA type is

- receiving section (#1) 32-1 and the receiving section (#2) 32-2, which includes one or more finger sections (#1 to #m) 31-1 to 31-m and finger sections (#m+1 to designed so as to include the two-system of the #n) 31-(m+1) to 31-n, and the synchronization 20
- the channel switching operation, the data reception and the synchronization establishment determination At the time determining sections 33-1 and 33-2.

channel switching timings between the network side and channel switching operation is carried out. Thus, the parameter data before and after the channel switching operation. Then, the network side determines whether or not the the mobile communication terminal can be matched to are carried out using the respective channel each other.

the CDMA type according to this embodiment, channel switching sequence resulting from the addition rate, or the change of the spreading code or the like. communication, the change of the data communication possible to improve the success rate of the In this way, in the mobile communication the service bearer during the or the removal of terminal of it is

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80 At the as to include the two-system of the receiving section establishment determination is NG, and only the user carried out in the respective channel parameter data data of the receiving section is processed when the communication terminal of the CDMA type is designed reception and the synchronization determination are time of the channel switching operation, the data before and after the channel switching operation. discarded when the result of the synchronization Then, the user data of the receiving section is (#1) 32-1 and the receiving section (#2) 32-2. in this embodiment, the mobile result of the synchronization establishment Also, 20 25

of possible to reduce the error generation probability the user data at the time of the channel switching. type, it Thus, in the mobile communication terminal of the CDMA determination is OK.

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- switching operation is instructed by the network side, mentioned above, in the channel switching method of the present invention, at the time of the channel switching operation in the network side and the mobile communication terminal, when the channel
- reception using the channel setting parameters before simultaneously with the synchronization determination and the data reception using the channel setting the channel switching operation are carried out the synchronization determination and the data 10
- the channel switching sequence. Thus, it is possible Thus, it is possible to improve the success rate of to obtain the effect that the success rate of the parameters after the channel switching operation. channel switching sequence can be improved. 15
- abnormal is discarded, and only the user data in which user data at the time of the channel switching can Also, in another channel switching method of the present invention, the user data in which the the effect that the error occurrence probability the result of the synchronization determination possible to result of the synchronization determination it is normal is processed. Thus, 25 20

the

CLAIMS:

- 1. A mobile communication terminal arranged for communicating within a network comprising:
- a radio section arranged to receive a radio signal
- from a network side via an antenna to produce a reception data signal from the received radio signal and to produce a transmission signal from a transmission data signal, and arranged to transmit a radio signal corresponding to said transmission signal to said network side via said antenna;
- first pilot symbol signal and a first data symbol signal from said reception data signal using a first channel parameter as a current channel parameter and arranged to determine synchronization establishment
 - 15 from said first pilot symbol signal;
- a second receiving section arranged to produce a second pilot symbol signal and a second data symbol signal from said reception data signal using said first channel parameter as a current channel parameter
- 20 and arranged to determine synchronization establishment from said second pilot symbol signal;
- a transmitting section arranged to transmit said transmission data signal to said radio section using said first channel parameter as a current channel
- an integral synthesizing section arranged to

parameter;

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selectively combine. said first data symbol signal and second data symbol signal to produce a reception data symbol signal;

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transmission data to said transmitting section, and to a processing section arranged to process said channel parameter to a second channel parameter when output a channel switching signal from said first said reception data symbol signal contains said reception data symbol signal, to output said channel switching signal; and 35

transmitted from said transmitting section, to set said section and said transmitting section, and arranged switching instruction such that said acknowledge is synchronization establishment in each of said first second channel parameter to said first receiving control section arranged to output an processing section in response to said channel acknowledge as said transmission data to said to receive said determining result of the 45

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been established after said first channel parameter is first receiving section that the synchronization has The mobile communication terminal according section serves to set said second channel parameter to claim 1, wherein when it is determined in said set to said first receiving section, said control

second receiving sections.

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to said second receiving section.

- section such that said switching completion is trans-The mobile communication terminal according is arranged to output a switching completion as said second channel parameter to said second receiving transmission data to said processing section in oţ response to the completion of the setting to claim 2, wherein said control section mitted from said transmitting section ښ •
- first receiving section that the synchronization has The mobile communication terminal according been not established, and it is determined in said to claim 1, wherein when it is determined in said
- second receiving section that the synchronization has been established, after said first channel parameter is set to said first receiving section, said control section serves to set said first channel parameter said first receiving section and said transmitting
- to claim 4, wherein when said control section receives said channel switching instruction again, said control The mobile communication terminal according section outputs said acknowledge as said
- response to said channel switching instruction such transmission data to said processing section in

transmitting section, and then serves to set said second channel parameter to said first receiving section and that said acknowledge is transmitted from said said transmitting section, and to receive said determining result of the synchronization

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establishment in each of said first and second

receiving sections.

The mobile communication terminal according wherein said or more of claims 1 to 5, first receiving section comprises to any ٠

data signal from said reception data signal at a chip which is arranged to produce a symbol rate reception a plurality of finger sections, each of parameter; rate using said current channel

synthesize said symbol rate reception data signals to produce said first pilot symbol signal and said first signal to said integral synthesizing section, and to data symbol signal and output said first data symbol a synthesizing section arranged to output said first pilot symbol;

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establishment from said first pilot symbol signal and synthesizing section and said control section, and to output the determining result to said integral a synchronization determining section arranged to determine the synchronization

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said second receiving section comprises:

a plurality of finger sections, each of which signal from said reception data signal at a chip rate is arranged to produce a symbol rate reception data using said current channel parameter; 20

said said integral synthesizing section, and to output said and said second data symbol a synthesizing section arranged to synthesize signal and outputs said second data symbol signal to to produce said symbol rate reception data signal second pilot symbol signal second pilot symbol; and 25

and to output the determining result to said integral astablishment from said second pilot symbol signal a synchronization determining section synthesizing section and said control section. arranged to determine the synchronization

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a network side having a base station; and including a mobile communication terminal according to any one or more of claims 1 to 6, A communication system comprising:

parameter when said acknowledge is received wherein said network side sets said second

The communication system according to claim communication terminal when said acknowledge is not 7, wherein said network is arranged to re-transmit said channel switching instruction to said mobile

- received.
- The communication system according to claim communicate with said mobile communication terminal parameter when said 7, wherein said network side is arranged switching completion signal is received. using said second channel 6

'n

- A channel switching method comprising the steps of: 9
- (a) in a mobile communication terminal, replying switching operation from said first channel parameter channel switching instruction instructing a channel instruction using a first channel parameter, sald to an acknowledge from a transmitting section in response to reception of a channel switching
- said first channel parameter to said second channel carrying out said channel switching operation from (b) in said mobile communication terminal, parameter in a first receiving section and said transmitting section; and 10

to a second channel parameter;

- in said mobile communication terminal, holding said first channel parameter in a second receiving section. <u>0</u>
- The channel switching method according to 11:

claim 10, further comprising the step of:

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- checking synchronization establishment in said first (d) in said mobile communication terminal,
- receiving section and a second receiving section after channel switching operation; the
- The channel switching method according to claim 11, further comprising the step of: 12.
- parameter in said second receiving section, when it is said first channel parameter to said second channel carrying out said channel switching operation from (e) in said mobile communication terminal, determined by said first receiving section that synchronization is established.
- The channel switching method according to claim 12, further comprising the step of: 13.
- (f) transmitting a switching completion signal from said mobile communication terminal
- The channel switching method according to claim 11, further comprising the step of: 14.
- said second channel parameter to said first channel transmitting section, when it is determined by said carrying out said channel switching operation from parameter in said first receiving section and said (g) in said mobile communication terminal,

receiving section that synchronization is established. first receiving section that synchronization is not established and it is determined by said second

- The channel switching method according to 15. 70
 - parameter to said second channel parameter when said channel switching operation from said first channel (h) in a base station, carrying out the claim 10, further comprising the step of: acknowledge is received. 2
- 40 The channel switching method according claim 10, further comprising the step of: 16.
- communication terminal , when said acknowledge is not (i) in a base station, re-transmitting said channel switching instruction to said mobile

received.

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- The channel switching method according to claim 13, further comprising the step of: 17.
- (j) communicating between a base station and said mobile communication terminal using said second
- channel parameter. S

reference to and as illustrated in Figs. 4, 5 and substantially as hereinbefore described with A mobile communication terminal of the accompanying drawings. 18.

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illustrated in Figs. 4, 5 and 6 of the accompanying A communication system substantially as hereinbefore described with reference to and as drawings. 19.

A channel switching method substantially as illustrated in Fig. 6 of the accompanying drawings. hereinbefore described with reference to and as 20.







GB 0227652.5 1-20 Application No: Claims searched:

John Betts 22 May 2003 Examiner: Date of search:

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and pa	Category Relevant Identity of document and passage or figure of particular relevance to claims
¥		GB2327013 A	(Ericsson)
. ⋖		EP0526436 A1	(Ericsson)
<		GB2281177 A	(Nippon Electric)

Categories:

×	Document indicating fack of novetry or inventive step	<	A Document indicating technological background and/or state of the an.
>	Document indicating lack of inventive step if combined with one or more other documents of same category.	۵.	P Document published on or after the declared priority date but before the filling date of this invention.
48	& Member of the same patent family	13	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC": H4L

Worldwide search of patent documents classified in the following areas of the IPC7:

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De following online and other databases have been used in the preparation of this search report.

EPODOC, WPI, JAPIO